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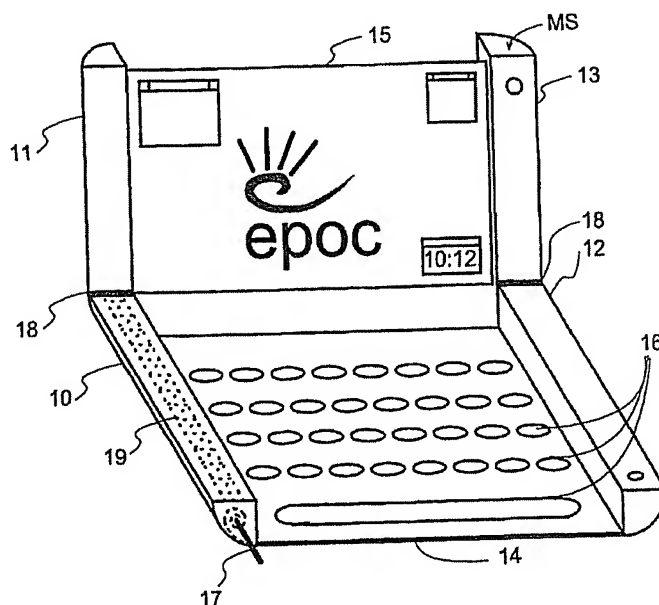
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(54) Title: USER INTERFACE



(57) Abstract: An electronic input device (MS) has a flexible keyboard (14) for receiving user input and a housing (10) defining a space for accommodating the keyboard. The input device has a compacted state and an extended state. The keyboard adopts a compacted spatial configuration in the compacted state and adopts an extended spatial configuration in the second state. In the compacted state the keyboard is wound on a roll. The input device additionally has a retractable, flexible display having corresponding compacted and extended states so that both the keyboard and the display can be rolled in and out together.

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User interface

The invention relates to user interfaces, and relates especially to minimising the size of user interfaces.

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During the last two decades different types of small electronic input devices have been developed, especially for mobile telecommunication. These devices generally have a keypad comprising either a set of buttons typically used on a telephone handset or a small keyboard in the QWERTY format.

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It is common in such electronic input devices to provide a display to let a user see information which has been entered via the keypad or keyboard and to provide the user with other information such as received messages, instructions or other information. Developments in electronic and battery technologies have allowed
15 manufacture of ever smaller devices having ever greater functionality. This improvement in functionality has enabled users to interact with electronic input devices in more ways, which has led to more menu options being available. Consequently, electronic input devices generally require a relatively large display and a large number of input keys. It is now common for users to carry their
20 electronic input devices with them most of the time. This increased mobility generally limits the size of electronic input devices to a handheld size. Furthermore, since they are now often carried about, they need to be robust. There is thus a conflict between the need to have a large display and a large keyboard to allow ease of use and the need to have a small portable electronic
25 input device.

In order to keep the size of electronic input devices small, it is known to provide browsing menus to display only a small number of available options and/or information at any one time and to reduce the size of keyboard keys. However,
30 user interfaces of newer and more complicated devices, such as mobile telephones and Personal Digital Assistants, often have a computer-like functionality, and so require a display which is capable of displaying text (having a

number of rows) and graphics. QWERTY format keyboards are often provided. An example of such a device is the Nokia® 9000 Communicator. This is in the form of a two-part mobile station comprising a complete QWERTY format keyboard in one part and a display having 640 x 200 pixels in the other part. The two parts are
5 joined together by a hinge.

Now a user interface for an electronic input device has been invented, which input device has an input means extractable from a storage space of the device into an extended state and retractable back into the storage space into a retracted state.
10 Thus, the size of the data input device can conveniently be made smaller for transport whilst the input means is protected in the storage space. The electronic input device can subsequently be put into a larger size when the input means is to be used.

15 According to a first aspect of the invention there is provided an electronic input device comprising:

- a flexible input means for receiving user input; and
- a housing defining a space for accommodating said input means;

characterised in that

20 said input device has a first state and a second state; wherein
the input means adopts a compacted spatial configuration in the first state and adopts an extended spatial configuration in the second state.

Preferably, the input means has an input surface having touch sensitive areas.

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Preferably, the compacted state is non-planar. All or part of the input means may adopt the compacted spatial configuration. In this way, a smaller input area, or no input area at all, is provided to the user.

30 Preferably, the extended spatial configuration is planar. All or part of the input means may adopt the extended spatial configuration. In this way, the input means provides an input area to a user.

Advantageously, the size of the electronic input device can be reduced, for example by gathering the input means either partially or entirely into the housing, and increased to reveal a convenient large input means, for example by letting out
5 the input means either partially or entirely from the housing.

Preferably, in the second configuration the input means is wound into a roll. Alternatively, it may be folded. In one embodiment, it is a concertina arrangement.

10 Preferably, said device comprises means for moving said input means between said first and second configurations.

Preferably, said input means is a keyboard. In an embodiment in which the input means is a keyboard its size can be changed considerably thus allowing
15 construction of a small device with full keyboard functionality. It is an advantage of a full keyboard that the user can quickly and easily type text, and yet the input device can be compacted to a convenient small size to be easy to carry with the user during transportation.

20 Preferably, said input means is a display. Preferably, part of the display is arranged to display a key to implement a soft key the function of which can be varied by software. This has an advantage of combining an input and output means so that the same surface can be used both for displaying information to the user and for reading user input, and thus it is not necessary to provide a separate
25 display at all.

Preferably, the electronic input device comprises:

- a flexible output means for outputting information; and
 - a housing defining a space for accommodating said output means;
- 30 characterised in that
- said input device has a first state and a second state; wherein
 - the output means adopts a compacted spatial configuration in the first state

and adopts an extended spatial configuration in the second state.

Preferably, said flexible output means is a display.

5 Advantageously, the size of the display can be changed to a high extent. This allows construction of a small device with a large enough display to show a large amount of information at any one time, for example a WWW (World Wide Web) page or e-mail.

10 Preferably said output means and said input means are arranged so that the input device has two states corresponding to the first and second states of both input means and output means. In the first state both the input means and the output means are compacted and in the second state both the input means and the output means are extended. This provides the advantage of either simultaneous
15 extension or simultaneous compaction of both the input means and the output means.

Preferably, the electronic input device comprises a hinge for foldingly connecting the housing defining the space for accommodating said flexible output means to
20 the housing defining a space for accommodating said input means. This provides an electronic input device, which has a relatively large display, and a relatively large input means and yet can be packed into a compact configuration. This is particularly useful in reducing the size of an electronic input device that is always carried by a user.

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Preferably, the electronic input device is a telecommunications device. The telecommunications device may have a data terminal mode in its extended spatial configuration and a telephone mode in its compacted spatial configuration.

30 Preferably, the electronic input device comprises:

two elements, which are foldable about a hinge between an open configuration and a closed configuration,

a speaker located in one element, and
a microphone in another element.

The telecommunications device is unfoldable to separate the microphone and the
5 speaker. In this way the speaker may be located conveniently close to a user's
mouth and the microphone may be located conveniently close to the user's ear.
Advantageously the elements can be folded together to reduce the size of the
electronic input device.

10 Preferably, the electronic input device further comprises:

a stop to prevent the device being opened beyond a certain maximum
opening angle, and

a means for changing the maximum opening angle when the configuration
of the device is changed between the compacted spatial configuration and the
15 extended spatial configuration. This provides different maximum opening angles
for when the device is to be used in a telephone mode and when it is to be used in
a data terminal mode. For example, it is possible to reduce the opening of the
device to a convenient viewing angle for the data terminal mode. In the telephone
mode, the mobile station can be further opened to increase the distance of the
20 microphone and the speaker from each other.

The invention will now be described, by way of example only, with reference to the
accompanying drawings, in which:

- Figure 1 shows a perspective view from the front of a mobile station in a
25 transport mode;
- Figure 2 shows a side view of the mobile station of Figure 1 in a telephone
mode;
- Figure 3 shows a perspective view from the front of the mobile station of
Figure 1 in a telephone mode;
- 30 Figure 4 shows a perspective view from the front of the mobile station of
Figure 1 in a data terminal mode;
- Figure 5 shows an example of a support mechanism;

- Figure 6 shows a front view of the mobile station of Figure 1 in a partially extended mode;
- Figure 7 shows a cross section of the mobile station of Figure 6 along line A-A'; and
- 5 Figure 8 shows enlarged detail of Figure 6.

Figure 1 shows a mobile station MS in a retracted configuration, which is suitable for transportation and to be carried by a user, for example in a pocket. It can be seen that in this retracted, or folded-up, configuration the mobile station is
10 basically of a cylindrical shape. The mobile station comprises four elements 10, 11, 12, and 13, which have outwardly facing curved surfaces defining the cylindrical shape. The elements are a lower storage element 10, an upper storage element 11, a battery element 12 and an electronics housing element 13. The battery element 12 contains a battery for operating the mobile station. The
15 electronics housing element 13 contains mobile station electronics to enable the mobile station to be used as, among other things, a mobile telephone and as a data terminal.

Referring now to Figures 2 and 3 it can be seen that elements 11 and 10 and
20 elements 13 and 12 are hinged together with hinges 18. The elements 10 and 12 are adjacent to each other and form a first hinged entity. The elements 11 and 13 are correspondingly adjacent to each other and form a second hinged entity. Both of the hinged entities each move about the hinges as a unit. The mobile station is provided with a latch (not shown) to resist it being accidentally opened.
25 Alternatively, friction means may be provided for this purpose.

Figure 3 shows a perspective view from the front of the mobile station of Figure 1 in an opened, that is telephone, configuration. The first and second entities have been moved relatively with respect to each other about the hinges 18 and are
30 disposed at an angle of about 115°. This is a comfortable angle for the mobile station to be used as a telephone or as a data terminal as will be described below. The opened configuration reveals a telephone speaker 20 located close to the

upper end of the electronics housing element 13 and a microphone 21 located close to the lower end of the battery element 12. A telephone keypad 22 can be seen on a surface of the battery element 12, which surface faces a corresponding surface of the lower storage element 10. In another embodiment of the invention,
5 the user may give verbal input rather than pressing keys with the input being recognised by speech recognition.

Of course, the angle does not have to be exactly 115° but may be arbitrarily chosen. The angle may be either freely adjustable or it may be adjustable in
10 certain steps. There may only be two possible angles at which the mobile station may be fixed: in a completely closed configuration, where the angle is 0° , and in an open configuration, where the angle is typically within a range of 90 to 270 degrees, preferably less than 180 degrees. Alternatively, there may be a third fixed angle so that there are different angles for telephone use and for data
15 terminal use, as described later in this document.

Figure 4 shows a perspective of the mobile station of Figure 1 in an extended, data terminal, configuration. Pairs of elements forming each of the first and second hinged entities, that is elements 10 and 12 and elements 11 and 13 are connected
20 to each other by a flexible keyboard 14 and a flexible display 15 respectively. The upper storage element 11 provides a storage space into which the keyboard 14 can be wound and the lower storage element 10 provides a storing space into which the display 15 can be wound. Both the keyboard 14 and the display 15 are arranged to be wound into their respective storage spaces so that the mobile
25 station is in a suitable configuration for transportation or to be used as a telephone. This can be arranged by using any suitable means such as a spring-loaded or an electrically driven roller. In case of electrically driven winding, the battery can be connected to a miniature sized electrical motor in the lower storage element 10 with flexible wires extending beneath the keyboard 14. The elements
30 13 and 12 are provided with grips, which a user can grasp to pull the elements in respective pairs 10 and 12 and 11 and 13 away from each other. When these pairs are being separated, the keyboard 14 and the display 15 become removed

from their storage spaces and unwound partially or to their full extents. The keyboard 14 and the display 15 are electrically coupled to the electronics within the electronics housing element 13. The device also comprises a flexible flat cable (not shown) extending across the hinges 18 to couple the battery, the keypad and the keyboard 14 to the electronics in the electronics housing element 13. Thus the electronics drives the display 15 and receives input from the keyboard 14.

Since the keyboard 14 and the display 15 are flexible and can be wound, they do not need to be sharply folded. Alternatively, the keyboard 14 and the display 15 may be stored in their respective storage spaces in a concertina type arrangement having a suitable mechanism to retract them.

In the extracted configuration, the keyboard 14 and the display 15 are parallel in the direction of their longest side, although they do not necessarily share the same plane.

In one embodiment of the invention the keyboard 14 is a touch pad arrangement for sensing touch by a finger or by a touch pen 17 which is provided for this purpose. In this embodiment, the pen 17 is located in an end of the lower storage element 10. It is convenient to locate the pen 17 on, or adjacent to, an axis about which the keyboard 14 is wound. In this way, the pen 17 may be located inside the keyboard 14 when it is wound. The keyboard 14 is made of an EMFi film, as is known to a person skilled in the art. A set of keys 16 is printed on the keyboard 14 to indicate to a user where to press. In another embodiment, the keys of the keyboard are not printed but instead the keyboard is capable of displaying virtual keys 16, that is soft keys, which are to be pressed. Using soft keys allows dynamic mapping and thus enhances the variability of the keyboard so that it can be adapted to receive input of different kinds in different circumstances. For example, the mobile station can show legends for shortcut keys (such as CTRL A) adjacent to certain keys. These legends may be customised by different applications. In another embodiment, rather than providing a keyboard, a touch pad is provided which can be used as a drawing surface for a drawing application or used as a

general input device. For example, it could be used to extend the display area to provide an expanded view to a document or an image.

The display 15 is a paper-like display element. Manufacturers for such display elements comprise E-Ink Inc. & Massachusetts Institute of Technology and Rank Xerox Corporation. Rank Xerox has described one type of paper-like displays called "gyricon": "A gyricon sheet is a thin layer of transparent plastic in which millions of small beads, somewhat like toner particles, are randomly dispersed. The beads, each contained in an oil-filled cavity, are free to rotate within those cavities. The beads are 'bichromal', with hemispheres of contrasting color (e.g. black and white), and charged so they exhibit an electrical dipole. Under the influence of a voltage applied to the surface of the sheet, the beads rotate to present one colored side or the other to the viewer. A pattern of voltages can be applied to the surface in a bit-wise fashion to create images such as text and pictures. The image will persist until new voltage patterns are applied to create new images.' ... ' For applications requiring more rapid and direct electronic update, the gyricon material might be packaged with a simple electrode structure on the surface and used more like a traditional display. Gyricon is described at <http://www.parc.xerox.com/dhl/projects/epaper/>.

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The first hinged entity is relatively massive compared to the second hinged entity so that the first entity can lie flat upon a surface when the mobile station is opened. This applies even when the second hinged entity is disposed at an angle to the first hinged entity of more than 90°. In this way, the mobile station is self-supporting when in a data terminal mode. Therefore, the mobile station can be placed on a desk and not topple over. This stability can be provided by locating heavy parts of the mobile station, such as the battery, in the battery housing element 12. Alternatively, it can be provided by locating the majority of the weight in the battery housing element 12 away from the hinges 18 and the majority of the weight in the electronics housing element 13 close to the hinges 18.

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The mobile station may also comprise a frame located beneath the keyboard 14

and the display 15. The frame holds the mobile station in the extended configuration. The frame is extendable and retractable. The frame also provides support to the back faces of the keyboard 14 and the display 15 to enable the mobile station to be used on an uneven surface or in the hands of a user. In any case, whether or not a frame is provided, winding of the keyboard 14 and the display 15 can be arranged to occur only in response to user initiation so that the mobile station can be laid on a desk or other such flat surface and stay in the extended configuration.

Figure 5 shows an example of a frame provided to support the keyboard. The frame comprises three sets of folding support bars 52. Each set has four support bars which pivot about pivots 56 at both ends. The support bars 52 of each set are maintained in a parallel configuration with corresponding support bars 52 in the other sets. The support bars 52 mechanically connect the battery housing element 12 with the lower storage element 10. The mechanism further comprises three intermediate bars 58, which connect the three sets together. The intermediate bars 58 force corresponding support bars 52 from each set to stay parallel when the mobile station is extended or retracted. In an embodiment in which the support bars 52 comprise conductive material, they can be used electrically to couple the keyboard and battery housing elements 10 and 12. Alternatively, one of these sets can support an electrical lead coupling these elements. A similar frame arrangement can be used to support the display 15.

Figure 6 shows a front view of the mobile station in a partially extended mode. The battery housing element 12 and the electronics housing element 13 are provided with a stop mechanism. The stop mechanism uses a stud 62 provided on the upper storing element 11.

Figure 7 shows a cross section of the view of the mobile station in Figure 6 along the line A-A'. This embodiment has three fixed opening angles. On a wall facing towards the upper storage element 11, the electronics housing element 13 has a recess 74 on its side at its lower end, close to the hinge 18.. The recess has a

form of a sector of approximately 45 degrees. The hinged end of the electronics housing element forms the first straight side or radius of the sector.

5 The battery housing element 12 has a wall that faces towards the lower storage element 10. This wall has an extending flange 72. The flange is basically an extension of the wall going beyond the end of the battery housing element 12. The flange has a sector shape in side view. The flange has an arc extending from the lower side of the battery housing element. The arc extends over an angle of about 60 degrees and terminates at a straight side connecting the arc to the upper side of the battery housing element. The narrow apex of the flange is thus towards the hinge. The flange is aligned in proportion to the hinge so that it enters the recess when the mobile station is opened about the hinges. At a certain first opening angle, the flange fills the entire recess and a leading edge 73 meets the end 77 of the recess.

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In order to provide two different opening angles, there is a stop 76. The stop is an extension of the wall of the electronics housing element 13, which faces towards the upper storage element. The stop follows the plane of this wall and extends a few millimetres over the recess 74. The stop and the flange are both aligned to the level of the outer surfaces of the electronics housing element 13 and battery housing element 12. In other words, the stop 76 and the flange 72 occupy a common plane. The flange has two configurations, a relaxed and a bent configuration. In the bent configuration, the flange is slightly bent sideways. The recess is dimensioned deeply enough so that there is space behind the stop for the flange to slide, when the flange is in the bent configuration.

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There are three abutment surfaces. The flange 72 has the first abutment surface 73 that is its leading edge. This surface prevents further opening of the mobile station beyond a certain opening angle. The recess 74 has an inner wall (the second direct wall of the sector) defining the second abutment surface 77, which defines the first opening angle. This first opening angle defines the maximum opening angle when the mobile station is being used as a telephone. The stop 76

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provides a third abutment surface which faces roughly towards the hinged end of the electronics housing element. When the mobile station is being used as a data terminal that is in the extracted configuration, the stud 62 is far from the flange, the flange moves along the plane of the side walls of the battery and electronics housing elements, and at a certain point engages with the stop.

The operation of the stop mechanism will now be described referring to Figures 6, 7 and 8. The flange 72 has a relaxed configuration in which it is not pressed upon by the stud 62. This is shown in Figure 6. In this configuration, when the flange engages the stop 76, further opening movement is prevented, and thus the maximum opening angle for the data terminal mode is defined. Additionally, the flange has a compressed configuration, in which the stud 62 presses the flange 72 into the recess. This happens when the mobile station is set into the telephone mode, that is the upper storage element 11 is brought next to the electronics housing element 13. In this compressed configuration, the first abutment surface 73 of the flange 72 can avoid the stop 76, and the flange slides through the gap. Thus, the mobile station can open until the flange is fully received by the recess 74, that is until the first abutment surface 73 engages the third abutment surface 77 of the recess. When the abutment surfaces are in contact, the battery housing element 12 and the electronics housing element 13 are stopped from opening any further.

The present invention provides several advantages over the prior art. A mobile station according to the invention occupies in its transportation mode a fraction of its fully opened size. In addition, it also has an intermediate configuration provided to enable the mobile station to be used for telephony. The invention can be applied to mobile telephones, personal digital assistants and small laptop computers to provide a screen of a presentation size. Alternatively it can be used for interactive posters in exhibitions, electronic games, user interfaces of various types of home and business electronics like hi-fi-sets, car audio systems, and multimedia devices used, for example, in aeroplanes.

This paper presents the implementation and embodiments of the invention with the help of examples. It is obvious to a person skilled in the art, that the invention is not restricted to details of the embodiments presented above, and that the invention can be implemented in another embodiment without deviating from the characteristics of the invention. The invention was here described using the most complex embodiment as an example, but naturally the invention can also be implemented in a device comprising merely a retracting keyboard without neither display properties nor mobile telephone functionality etc. Thus, the presented embodiments should be considered illustrative, but not restricting. Hence, the possibilities of implementing and using the invention are only restricted by the enclosed patent claims. Consequently, the various options of implementing the invention as determined by the claims, including the equivalent implementations, also belong to the scope of the present invention.

Claims

1. An electronic input device (MS) comprising:
a flexible input means (14) for receiving user input; and
5 a housing (10) defining a space for accommodating said input means;
characterised in that
said input device has a first state (Figure 3) and a second state (Figure 4);
wherein
the input means adopts a compacted spatial configuration in the first state
10 and adopts an extended spatial configuration in the second state.
2. An electronic input device (MS) according to claim 1, wherein the input means
(14) has an input surface having touch sensitive areas (16).
- 15 3. An electronic input device (MS) according to claim 1 or 2, wherein the
extended spatial configuration is planar.
4. An electronic input device (MS) according to any preceding claim, wherein the
compacted spatial configuration is non-planar.
- 20 5. An electronic input device (MS) according to any preceding claim, wherein in
the compacted spatial configuration the input means (14) is wound into a roll.
6. An electronic input device (MS) according to any preceding claim, comprising
25 means (11,12) for moving said input means (14) between said first and second
configurations.
7. An electronic input device (MS) according to any of preceding claims, wherein
said input means is a keyboard (14).
- 30 8. An electronic input device (MS) according to any of preceding claims, wherein
said input means (14) is also a display.

9. An electronic input device (MS) according to any preceding claim comprising:
a flexible output means (15) for outputting information; and
a housing (11) defining a space for accommodating said output means;
5 **characterised in that**
said input device has a first state and a second state; wherein
the output means adopts a compacted spatial configuration in the first state
and adopts an extended spatial configuration in the second state.
- 10 10. An electronic input device (MS) according to claim 9, wherein said output
means is a display (15).
11. An electronic input device (MS) according to claim 9 or claim 10, wherein said
output means is arranged parallel with said input means so that the input
15 device has two states corresponding to the first and second states of both input
means and output means.
12. An electronic input device (MS) according to any of claims 9 to 11, comprising
a hinge (18) for foldingly connecting the housing (11) defining the space for
20 accommodating said output means to the housing (10) defining a space for
accommodating input means.
13. An electronic input device (MS) according to any preceding claim, wherein the
electronic input device is a telecommunications device.
25
14. An electronic input device (MS) according to claim 13 comprising:
two elements (10 and 12, 11 and 13), which are foldable about a hinge (18)
between an open configuration and a closed configuration;
a speaker (20) located in one element, and
30 a microphone (21) in another element so that the electronic input device
can be unfolded to separate the microphone and the speaker.

15. An electronic input device (MS) according to claim 14 comprising:
a stop (76) to resist opening the two elements (10 and 12, 11 and 13) of the
input device over a certain maximum opening angle, and
means for changing the maximum opening angle when the configuration of
the device is changed between the compacted spatial configuration and the
extended spatial configuration.
16. A method for manufacturing of an electronic input device (MS) comprising the
steps of:
forming to the electronic input device a housing (10) to define a space for
accommodating a flexible input means; and
inserting a flexible input means in a compacted spatial configuration at least
partially into said space.
17. A method for manufacturing of an electronic input device (MS) comprising the
steps of:
forming to the electronic input device a housing (10) to define a space for
accommodating a flexible input means;
shaping the flexible input means into a compacted spatial configuration; and
inserting the flexible input means at least partially into said space.
18. A method of an electronic input device presenting a user interface, comprising
the steps of:
storing a flexible input means in a compacted spatial configuration within a
housing of the electronic input device;
extending the flexible input means out of the housing into an extended
spatial configuration for receiving user input; and
retrieving the flexible input means again into the compacted spatial
configuration within the housing.

Fig. 1

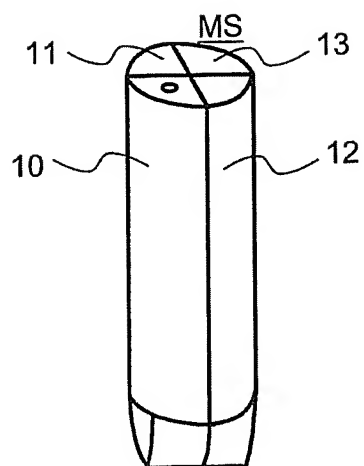


Fig. 2

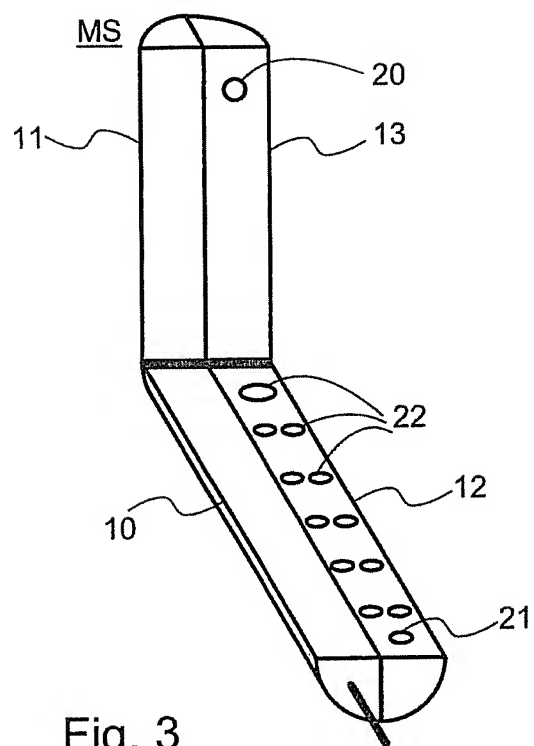
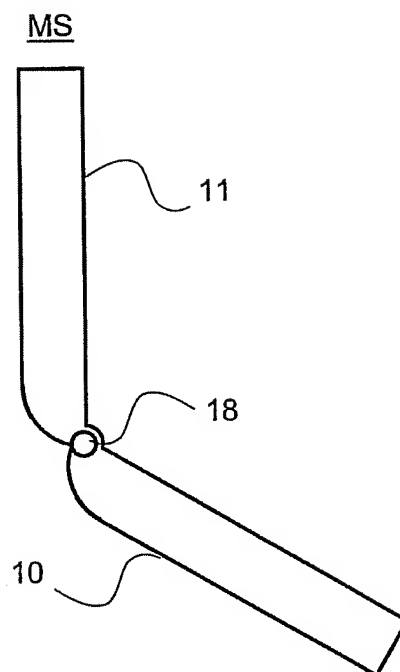


Fig. 3

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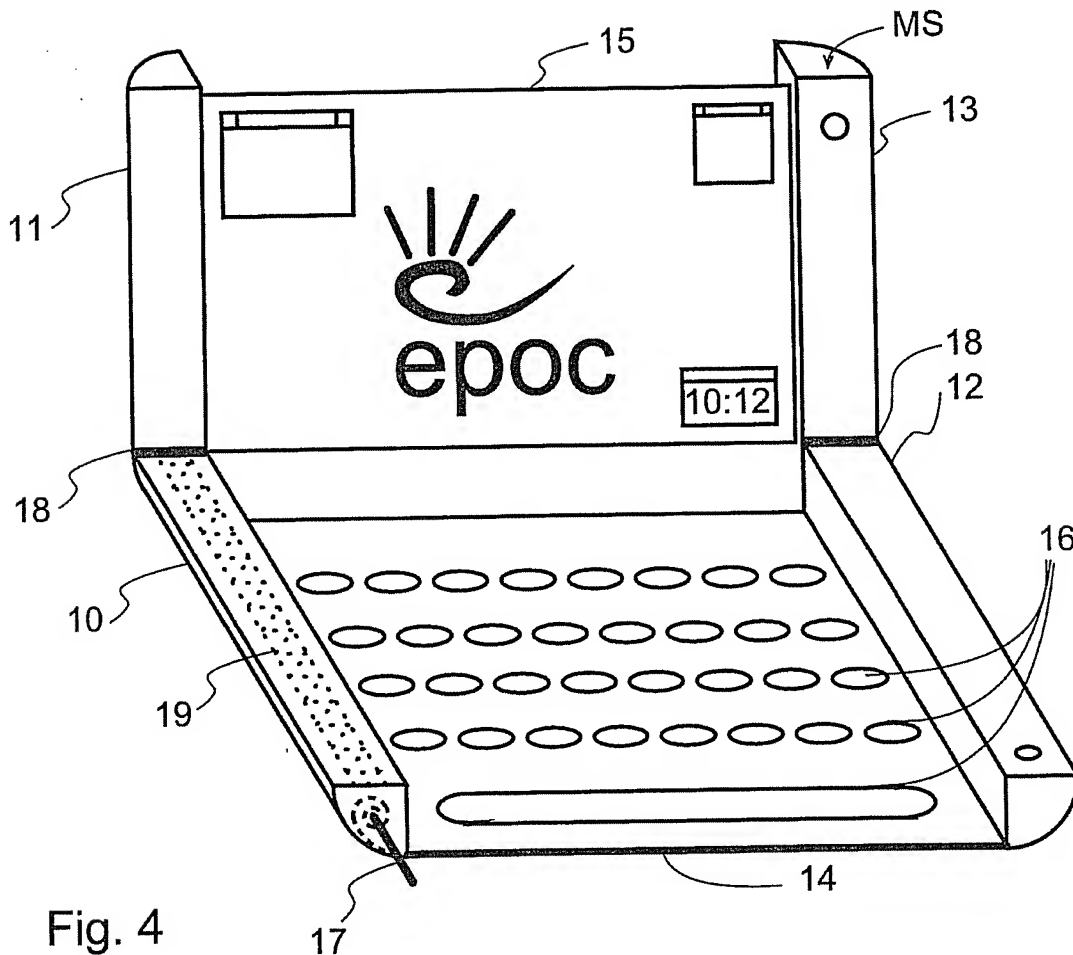


Fig. 4

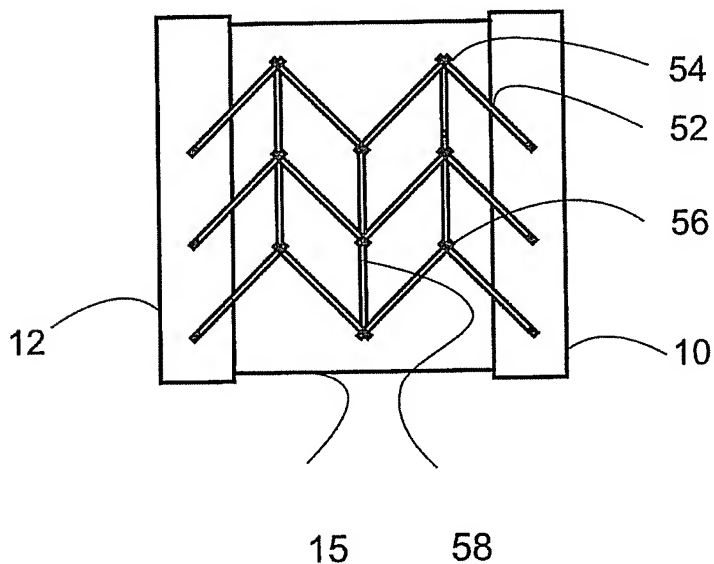


Fig. 5

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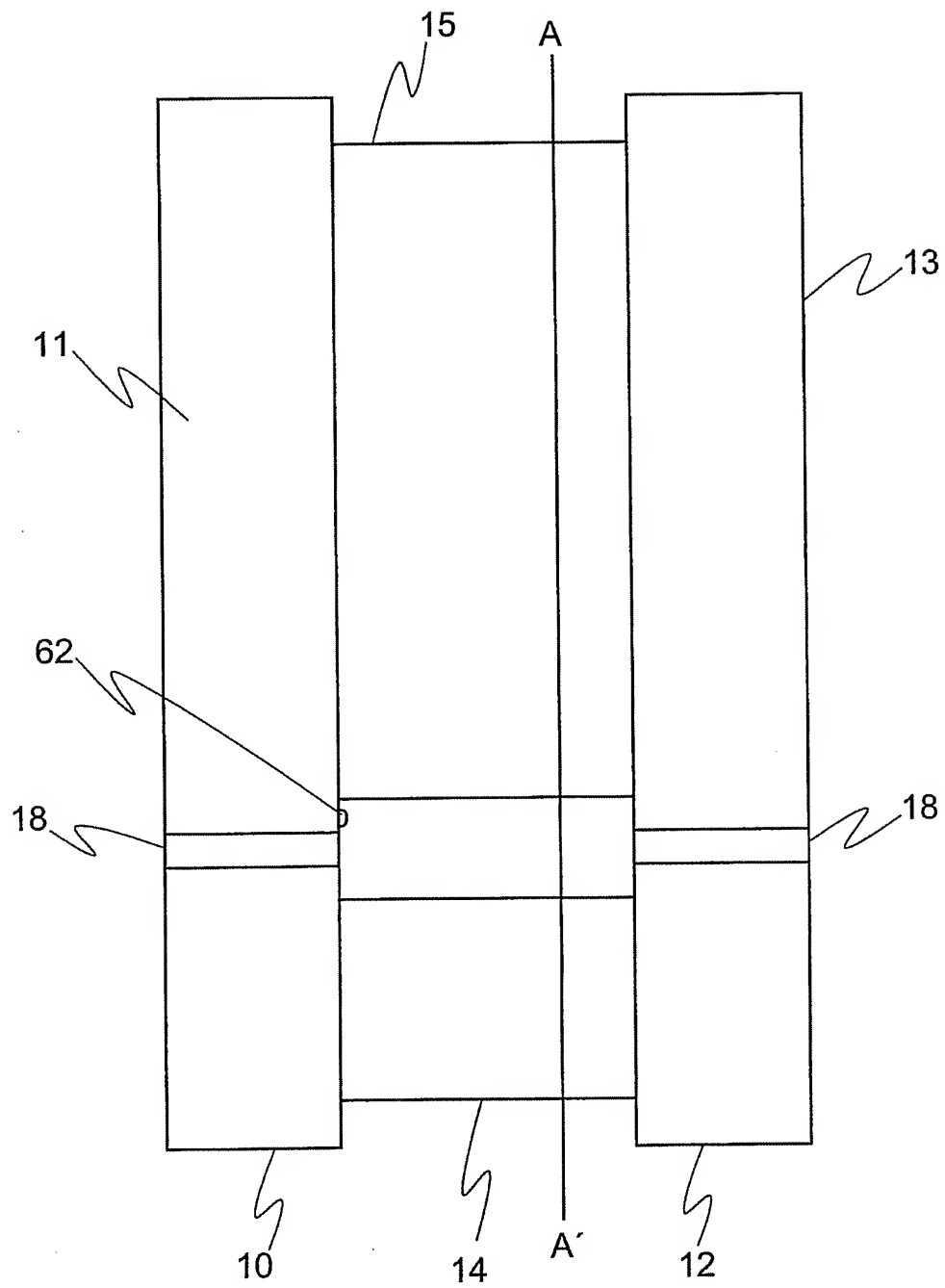


Fig. 6

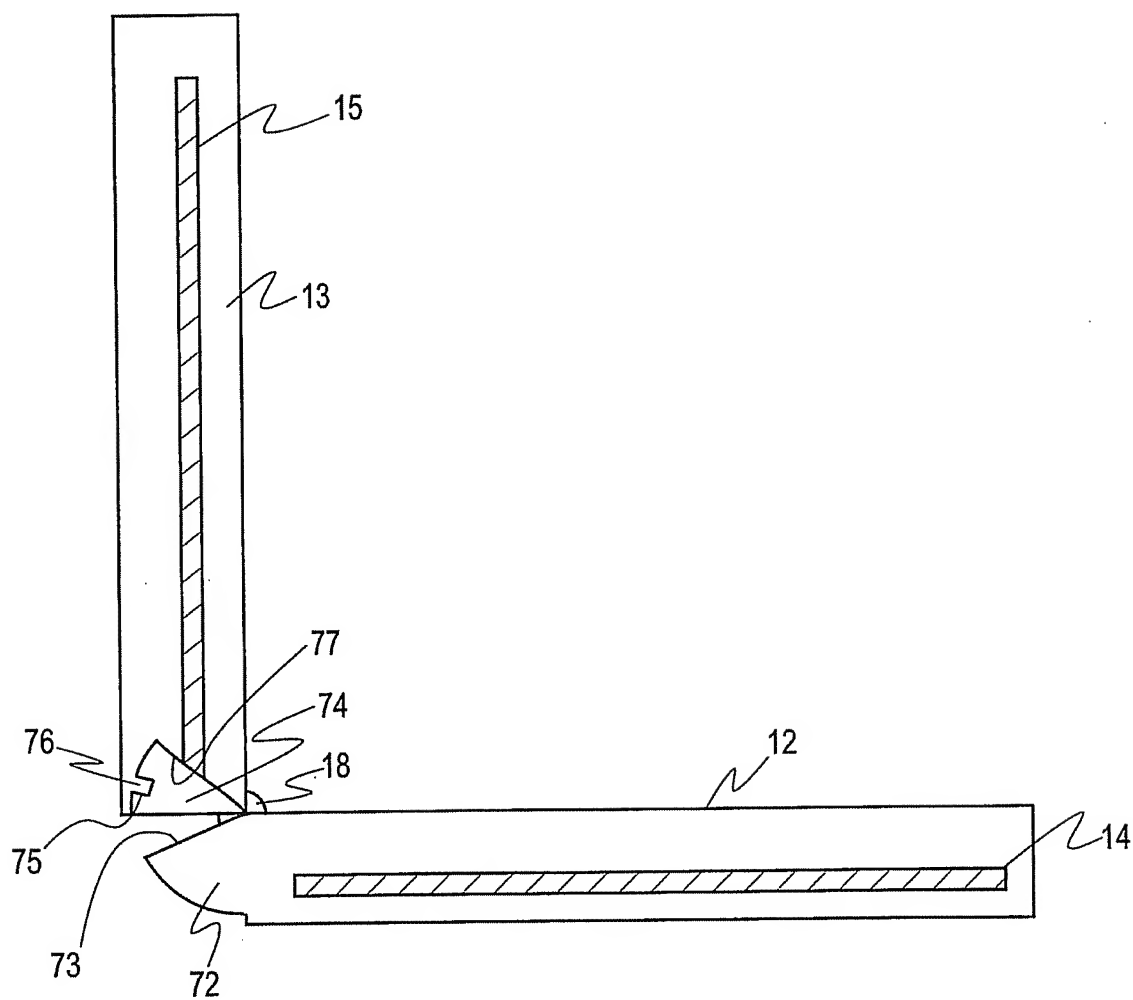


Fig. 7

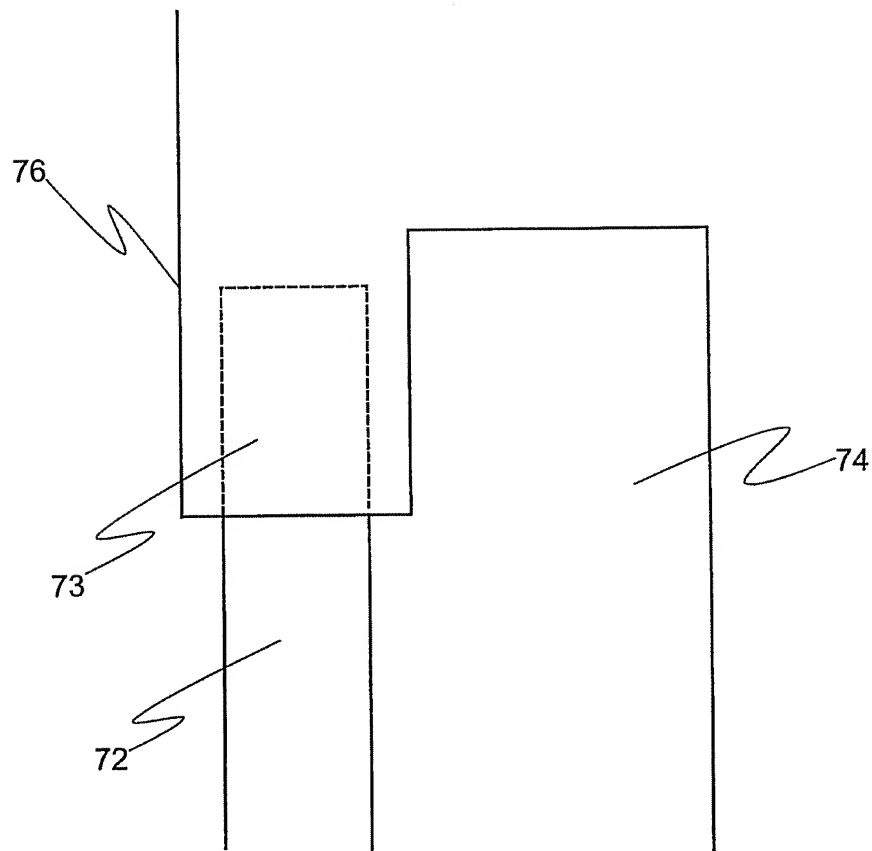


Fig. 8

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A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G06F1/16 G06F3/02 H04M1/02 B41J5/10 G09F9/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G06F H04M B41J G09F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

PAJ, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 01, 31 January 2000 (2000-01-31) & JP 11 272205 A (TOSHIBA CORP), 8 October 1999 (1999-10-08) abstract	1,9
P,X	WO 00 54479 A (RENFER ROBERT O) 14 September 2000 (2000-09-14) the whole document	1-9,13, 16-18
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☒ Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search

7 March 2001

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Name and mailing address of the ISA

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Jan Silfverling

INTERNATIONAL SEARCH REPORT

Int ional Application No
PCT/FI 00/00995

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 616 897 A (WEBER MICHAEL R ET AL) 1 April 1997 (1997-04-01) abstract; figure 3	1
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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(19) World Intellectual Property
Organization
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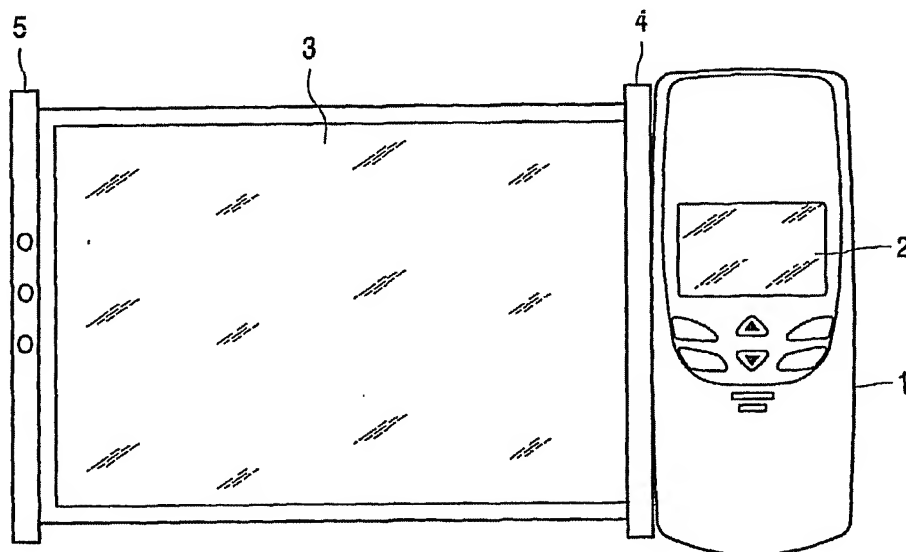
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WO 2004/001704 A1

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- (71) Applicant (for all designated States except US): **KONINKLIJKE PHILIPS ELECTRONICS N.V.** [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).
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- (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
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- Published:
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- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: APPARATUS WITH DISPLAY



(57) Abstract: A display system (2) makes use of removable or detachable display devices (3), which are preferably rollable, such as cartridges which can be discarded after the display stops functioning. If necessary the display area (3) can be larger than the apparatus it is intended for.

Apparatus with display

The invention relates to an electronic apparatus suitable for displaying information via a display device, the display device having at least one display panel provided with driving electronics, the electronic apparatus being provided with means for providing display parameters to the display device.

5 The invention furthermore relates to a display device for use in such an apparatus and to a housing for such a display.

 The display device may belong to one of the groups of liquid crystal display devices, electrochromic display devices, electrophoretic display devices, reflective display devices including an interferometric modulator and luminescent display devices. The display
10 devices may be passive or active matrix display devices. Examples of such active matrix display devices are TFT-LCDs or AM-LCDs, (O) LED devices, which are used in laptop computers and in organizers, but also find an increasingly wider application in GSM telephones.

 Such matrix displays are generally addressed by means of selection lines
15 which periodically address (a group of) selection lines or rows, e.g. via switches such as TFT (MOS) -transistors, while at the main time data (voltages) are provided via (a group of) data lines or columns. So "display parameters" is meant to comprise these driving signals, but may also comprise other interface signals between the display device (module) and the electronic apparatus. For many applications this should preferably be a standard interface. It
20 may for instance comprise signals like a vertical synchronization pulse, a horizontal synchronization pulse, clock signals etcetera. It may also comprise information with respect to the size and resolution or any other relevant information (color or monochrome).

 In many applications nowadays, like laptop computers and organizers (but of course also in GSM telephones) portable (display) devices are preferred. Portability however
25 goes at the cost of a higher chance of breaking the display since most displays are rather fragile systems. The costs of exchanging a broken display from a portable device however are so prohibitively high that usually the device is replaced completely. Since 99% of the functionality still remains available, this is a waste of resources. The reasons for these high costs are twofold. First, the display is molded into the device to give it added strength.

Consequently, removing the display entails breaking the device. Second, once the display is removed a new display has to be aligned in the device and considering the large amount of connections (tens of thousands to more than a million) this is a complex task.

5 In other applications, especially mobile phones, a need is felt to have a display area, which is larger than the area available within the device. This need has been solved by introducing rollable displays. When moving to rollable displays the above mentioned protective measures have to be omitted while the substrates generally become much thinner and therefore more vulnerable.

10

It is one of the objects of the invention to overcome at least partly the above mentioned problem. To this end in an electronic apparatus according to the invention the display device is provided outside the electronic apparatus and is movable between a first position and a second position in which

15 the display device has a housing, the housing comprising the display device in one of the first and second positions.

In a preferred embodiment the display device is movable between a first position in which the display panel substantially is not visible and a second position in which at least part of the display panel is visible. Intermediate distinct positions may be made
20 available too.

By "substantially is not visible" it is meant that the greater part of actual display panel is not visible to the human eye, be it because it is within a housing or because the display panel is in a folded or rolled up position.

The invention is based on the insight that rather than making the displays more
25 robust one can make use of displays in housings (for instance cartridges) which displays (and housings) can be discarded after the display stops functioning. This is the more attractive when flexible displays (e.g. including integrated row and column drivers) are used and cheap "plastic electronics" becomes available.

The display device and the electronic apparatus may be mechanically
30 interconnected or mechanically interconnectable, dependant on the kind of use.

As mentioned above at least part of the display panel may be flexible which makes the use of rollable or foldable displays attractive. In this case a preferred embodiment has the housing at a side different from the side provided with the mechanical interconnection. This enables the use of such display devices in more than one apparatus and

even opens the possibility to "loading" such display devices with data, similar to loading badges, credit cards or similar devices. On the other hand such devices (badges, credit cards, identity cards) may be provided with a display function showing different images in time, or moving images.

5

These and other aspects of the invention are apparent from and will be elucidated with reference to the embodiments described hereinafter.

In the drawings:

10

Figure 1 shows the use of a rollable display device in mobile applications

Figure 2 shows an equivalent of such a rollable display device, while

Figure 3 is an electrical equivalent of a part of the display device while

Figure 4 shows a possible housing of the display device according to the invention and

15

Figure 5 shows a further device according to the invention.

The Figures are diagrammatic and not drawn to scale. Corresponding elements are generally denoted by the same reference numerals.

20

Figure 1 shows the use of such a display panel in a first kind of application. In Figure 1^a one typical example is given viz. the use of displays in a mobile telephone 1. A typical display device (panel) 2 of the mobile telephone has dimensions of e.g. 2 cm x 3 cm, whereas the mobile telephone itself has dimensions of e.g. 4 cm x 10 cm. A further rollable display 3 is provided inside a housing 4, 5 and may be interconnected to the mobile telephone 1 via interconnecting pins 6. The housing in this example comprises two different parts 4, 5, the display 3 in this example being situated in part 5 in its rolled form. Figure 1^b shows the unrolled display 3, which has dimensions of e.g. 10 cm x 15 cm.

25

Figure 2 shows the use of such a display panel in another kind of application. Now a display panel 3 is slidable within a housing 5. If necessary an edge 7 may be provided with (not shown) interconnecting means. To prevent the display panel 3 from sliding too far outside the housing 5 the display panel 3 and the housing 5 are provide with notches 8, 9 respectively. At the side of display the housing 5 may be either opaque, or transparent, in which case the display panel is viewable inside the housing, giving better protection.

30

Figure 3 is an electric equivalent circuit diagram of a part of a possible display device 3 according to the invention. It comprises in one possible embodiment (one mode of driving, called the "passive mode") a matrix of pixels defined by the areas of crossings of row or selection electrodes and column or data electrodes. The row electrodes are
5 consecutively selected by means of row drivers 11, while the column electrodes are provided with data via data registers 12. To this end, interconnections 13 between the row drivers and interconnecting pins 6 and between the data registers and interconnecting pins 6 are provided on the (flexible) display substrate 10. Reference numeral 14 represents the actual display area.

In another possible embodiment (another mode of driving, called the "active
10 mode") signals from the row drivers select the picture electrodes via thin-film transistors (TFTs) whose gate electrodes are electrically connected to row electrodes while the source electrodes are electrically connected to column electrodes .

Figure 4 schematically shows how part of the substrate 10 is fixed within housing part 4, for instance by means of a support structure 15. Electrical contacts to a (not
15 shown) wiring pattern on the substrate 10 are made via interconnecting pins 6. The housing part 5 in this example comprises a (spring-loaded) rolling device 17 for rolling up the (flexible) display substrate 10. The substrate is only partly rolled out of the (flexible) display substrate 10 in this example, so only a part of the display area 14 (the limits of the complete display area being denoted by points 14') is visible. Although not strictly necessary support
20 hinges 16 reinforce the mechanical stability of the construction. Furthermore in this example a locking mechanism 19 is schematically shown to lock the housing parts 4, 5 together when the display is a rolled position. To release the (flexible) display substrate 10 again the housing part 4 has a push button 18. This opens the possibility to start the display function when the button is pushed (when the display is released).

25 It is noted that the mechanism for rolling the display (in the housing part 4) is not on the same side of the cartridge (in this example the set of housings 4,5) as the part of the cartridge that connects to actual apparatus (e.g. a mobile phone). This is not only counter intuitive (compare rolling curtains that both connect to the outside world and roll-up on the same side, namely on the top) but it also enables much cheaper design of the cartridge.

30 The cheaper design on its turn opens the way to disposable cartridges, which on the other hand opens the way to use of disposable displays which can be plugged in at arbitrary places. Many applications can be thought of, for instance:

- plugging a disposable display into the wall of a (banking) office to see if waiting will take long (if necessary the display substrate may be provided with identification electronics).

- using the cartridge as a personalized display to plug it in special places for observing purposes (ranging from Kindergarten to stock inventory).

- an apparatus for giving lectures for (smaller) audiences in which the lecturer sees a small picture on the apparatus display while the audience at the opposite side of the rolled out display sees an enlarged picture, or even a moving picture.

- displaying monochrome (black/white) information on the rolled out part while simultaneously displaying (other) functional (color) displays on the apparatus display

- a pocket display for general-purpose applications.

These applications will be most attractive of course if a standard way of (mechanically) interconnecting the display to the apparatus is agreed upon as to the dimensions and functions of the interconnecting pins and if a (standard) protocol concerning the exchange of information exists, e.g. how to use different kinds of display panels (with different number of lines, number of columns etcetera) in different kinds of apparatuses.

The display may have a rotated position with respect to the embodiment of Figure 1. Figure 5 for example shows such a display connected to an apparatus 1, which itself does not necessarily has a display panel. The display panel has a much larger area then the apparatus1 (e.g. a mobile device for showing presentations), while interconnections to the apparatus are now provided at a side of the housing part 4 opposite to the position of the push button 18, as shown in Figure 4. On the other hand the housing part 4 may be incorporated in the apparatus 2, provided a contact between the display 14 and the circuitry inside the housing part 4 (the apparatus 2) is ensured. In this case the part of the substrate 10 inside the housing part 4 (the apparatus 2) need not be flexible.

The protective scope of the invention is not limited to the embodiments described, while the invention is also applicable to other display devices, for example, (O) LED displays, and other housing devices such as the embodiment shown in Figure 2.

On the other hand the electronic apparatus comprising the display device (panel) may be suited for different applications (e.g. both a telephone application and a calculator application) which each have different display panels (with different number of lines, number of columns etcetera). The display panels may even be realized in different technologies, e. g. (O)LED -technology for display 2 and LCD technology for display 14.

As mentioned in one of the possible applications an apparatus display 2 and the rolled out display area need not be visible from one single side. On the other hand the rollable display panel may be viewable from two opposite sides.

Also the interconnection between the apparatus and (part of) the display need
5 not be of an electro-mechanical kind, such as shown. Electromagnetic coupling (infrared radiation) may be used to provide data to the display in the cartridge. The display in the cartridge may be fed with a battery or, if necessary a supply circuit (e.g. comprising a coil) may be powered from the apparatus (either directly via the contacts or via infrared radiation.

The invention resides in each and every novel characteristic feature and each
10 and every combination of characteristic features. Reference numerals in the claims do not limit their protective scope. Use of the verb "to comprise" and its conjugations does not exclude the presence of elements other than those stated in the claims. Use of the article "a" or "an" preceding an element does not exclude the presence of a plurality of such elements.

CLAIMS:

1. An electronic apparatus suitable for displaying information via a display device, the display device having a display panel provided with driving electronics, the electronic apparatus being provided with means for providing display parameters to the display device, the display device being provided outside the electronic apparatus and being
5 movable between a first position and a second position in which the display device has a housing, the housing comprising the display device in one of the first and second positions.
2. An electronic apparatus according to claim 1, the display device being
10 movable between a first position in which the display panel substantially is not visible and a second position in which at least part of the display panel is visible.
3. An electronic apparatus according to claim 2, the display device being movable to at last one further position in which the display panel is partly visible.
15
4. An electronic apparatus according to claim 2, the apparatus or the display device comprising driving means for starting the display function upon release from the first position.
- 20 5. An electronic apparatus according to claim 1 or 2, the display device and the electronic apparatus being mechanically interconnected.
6. An electronic apparatus according to claim 1 or 2, the display device and the electronic apparatus being mechanically interconnectable.
25
7. An electronic apparatus according to claim 1 or 2, the display device and the electronic apparatus being interconnectable by electromagnetic coupling.

8. An electronic apparatus according to claim 1, 2 or 4, at least part of the display panel being flexible the display panel being rollable or foldable.
9. An electronic apparatus according to claim 5 or 6, the display panel having the housing at a side different from the side provided with the mechanical interconnection.
10. An electronic apparatus according to claim 1, 2 or 5, the display device in at least one of the first and second positions being fixed by a spring mounting.
11. An electronic apparatus according to claim 1 or 2 having a further display device.
12. An electronic apparatus according to claim 11 the further display panel being provided with driving electronics, the apparatus comprising driving means for displaying different images to the display device and the further display device.
13. An electronic apparatus according to claim 1, 2 or 5, the electronic apparatus comprising a controller for selecting at least one application for the display device and further comprising memory means for storing at least display parameters related to said application and means for providing said display parameters to an interface between the electronic apparatus and the display device.
14. A display device for use in an electronic apparatus according to claim 1, the display device having a display panel provided with driving electronics, the display device being movable between a first position and a second position in which at least part of the a display panel is visible, which display device has a housing, the housing comprising the display device in one of the first and second positions.
15. A display device according to claim 14, the display device being movable to at last one further position in which the display panel is partly visible.
16. A display device according to claim 14, the display device comprising driving means for starting the display function upon release of the display panel from the having.

17. A display device according to claim 14, at least part of the display panel being flexible the display panel being rollable or foldable.
18. A display device according to claim 14, the display device having the housing
5 at a side different from a side suited for mechanical coupling to the housing.
19. A display device according to claim 14, the display device in at least one of the first and second positions being fixed by a spring mounting.
- 10 20. A housing for comprising a display device according to claim 14, the display device being movable within the housing between a first position and a second position in which at least part of the a display panel is visible.
21. A housing according to claim 20, the display device being movable to at last
15 one further position in which the display panel is partly visible.
22. A housing according to claim 20, at least part of the display panel being flexible the display panel being rollable or foldable.
- 20 23. A housing according to claim 20, the display device in at least one of the first and second positions being fixed by a spring mounting.

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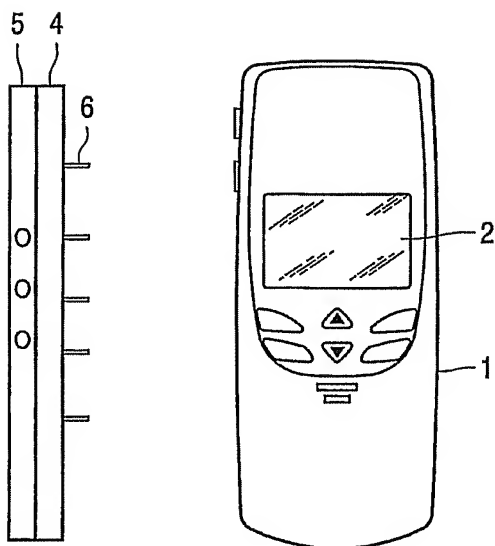


FIG. 1a

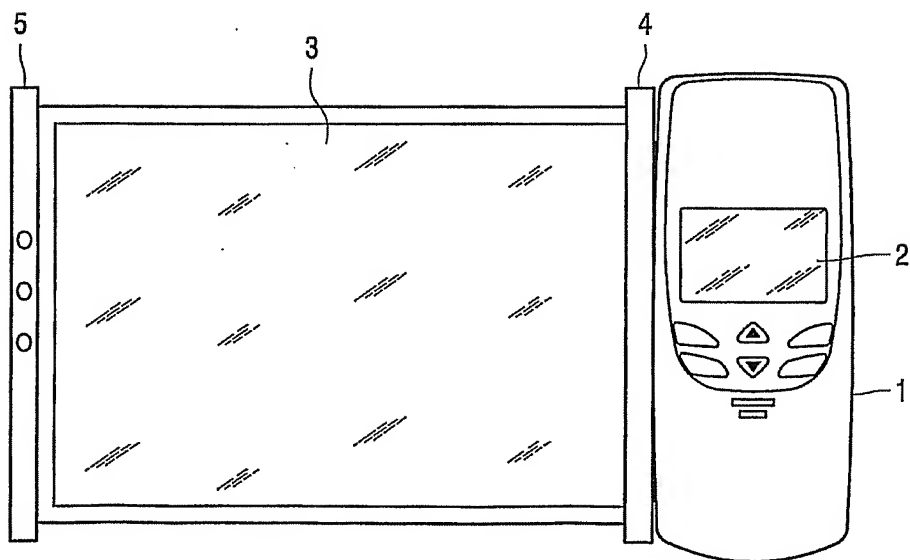


FIG. 1b

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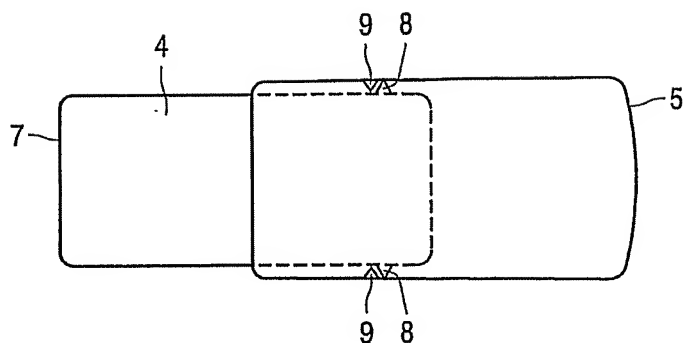


FIG. 2

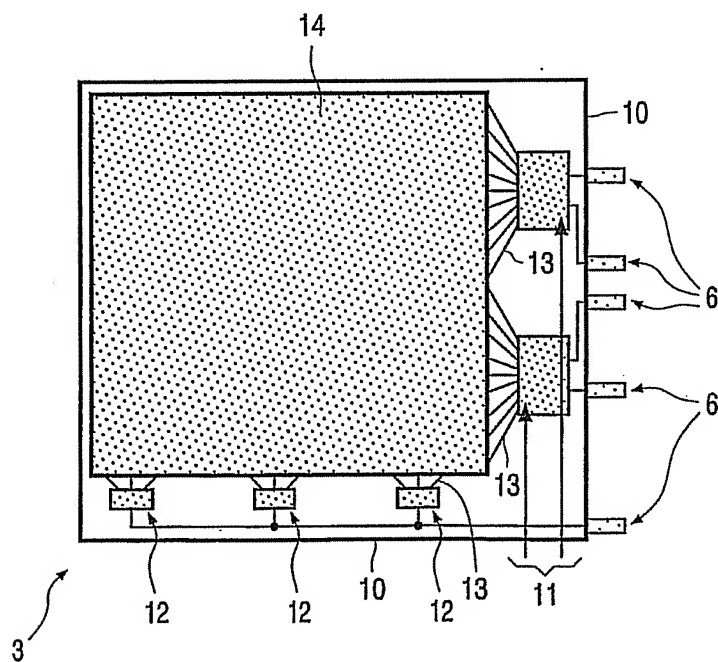


FIG. 3

3/3

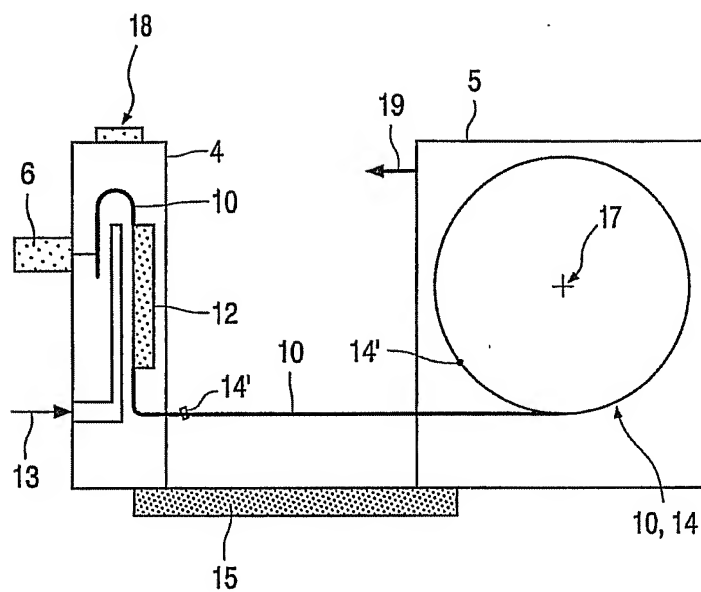


FIG. 4

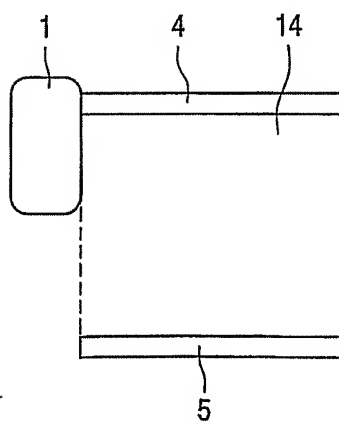


FIG. 5

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 03/02465

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G09F9/30 G09F9/37 G09F9/35 H04M1/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G09F H04M G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 02 47363 A (E INK CORP) 13 June 2002 (2002-06-13) page 5, line 21 - page 9, line 15 page 15, line 5 - line 30 figures 1-3	1-23
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X	DE 201 18 593 U (JAHN HARTMUT ; TRABERT MICHAEL (DE)) 23 May 2002 (2002-05-23) page 5, line 19 - line 30 figures 1,4	1-23

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Date of the actual completion of the international search

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Date of mailing of the international search report

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Name and mailing address of the ISA

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INTERNATIONAL SEARCH REPORT

International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 01, 31 January 2000 (2000-01-31) & JP 11 272205 A (TOSHIBA CORP), 8 October 1999 (1999-10-08) abstract -----	1-23
A	US 5 508 720 A (DISANTO FRANK J ET AL) 16 April 1996 (1996-04-16) the whole document -----	1-23
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